CLOTHES WASHER ADDITIVE DISPENSER APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

[0001] This invention relates generally to washing machines, and more particularly, to methods and apparatus for dispensing additives during a wash cycle.

[0002] Washing machines typically include a cabinet that houses an outer tub for containing wash and rinse water, a perforated clothes basket within the tub, and an agitator within the basket. A drive and motor assembly is mounted underneath the stationary outer tub to rotate the basket and the agitator relative to one another, and a pump assembly pumps water from the tub to a drain. The washing machine performs a number of operations to complete a wash cycle including a wash operation and one or more rinse and spin operations. See, for example, U.S. Patent No. 6,029,298.

[0003] Customarily, wash additives such as detergents, bleaching agents, fabric softeners, and the like, are added to the washer at various times during a wash cycle. Detergent is commonly added at the beginning of the wash cycle. However, other laundry aids, including bleach, are best added later in the wash cycle. Attending to the introduction of laundry additives at different times during the wash cycle can be inconvenient for the consumer.

[0004] At least some known washing machines provide dispensers for dispensing additives such as bleach to the washer at predetermined times during the wash cycle. In the dispensing of bleach, it is desirable that the bleach not directly contact the clothes before the tub is filled and the clothes are immersed in the water or before the bleach is diluted with water.

BRIEF DESCRIPTION OF THE INVENTION

[0005] In one aspect, an additive dispensing system for a washing machine is provided wherein the washing machine includes a tub for holding wash liquid and a basket for holding articles to be washed. The additive dispensing system includes a top cover, a reservoir removably coupled to the top cover, and a water valve coupled to the reservoir. A controller is coupled to the water valve. The

controller is configured to control the water valve to introduce water into the reservoir to dilute the additive and initiate delivery of the diluted additive to the washer at a predetermined time during a wash cycle.

[0006] In another aspect, a washing machine is provided that includes a tub for holding wash liquid, a basket for holding articles to be washed, and an additive dispensing system. The additive dispensing system includes a top cover, a reservoir removably coupled to the top cover, a water valve coupled to the reservoir, and a controller coupled to the water valve. The controller is configured to control the water valve to introduce water into the reservoir to initiate delivery of the diluted additive to the washer at a predetermined time during a wash cycle.

[0007] In another aspect, a method for dispensing an additive from a reservoir in a washing machine is provided, the washing machine including a tub, a basket, a memory, and a controller accessing the memory, and controlling a water valve. The method includes determining a total wash cycle time, determining an additive dispense time based on the total wash cycle time, activating a water valve to dilute the additive when the additive dispense time is reached, and dispensing the diluted additive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Figure 1 is a perspective cutaway view of an exemplary washing machine.

[0009] Figure 2 is front elevational schematic view of the washing machine shown in Figure 1.

[0010] Figure 3 is a perspective view of a portion of a top cover with a separable additive dispenser.

[0011] Figure 4 is a schematic block diagram of a control system for the washing machine shown in Figures 1 and 2.

[0012] Figure 5 is a flow diagram illustrating a method for controlling the dispensing of an additive in a washing machine.

DETAILED DESCRIPTION OF THE INVENTION

[0013] Figure 1 is a perspective view partially broken away of an exemplary washing machine 50 including a cabinet 52 and a top cover 54. A backsplash 56 extends from top cover 54, and a control panel 58 including a plurality of input selectors 60 is coupled to backsplash 56. Control panel 58 and input selectors 60 collectively form a user interface input for operator selection of machine cycles and features, and, in one embodiment, a display 61 indicates selected features, a countdown timer, and other items of interest to users. A lid 62 is mounted to top cover 54 and is rotatable about a hinge (not shown) between an open position (not shown) facilitating access to a wash tub 64 located within cabinet 52, and a closed position (shown in Figure 1) forming a substantially sealed enclosure over wash tub 64. As illustrated in Figure 1, machine 50 is a vertical axis washing machine. It is contemplated that the benefits of the invention accrue to other types of washing machines, including, but not limited to, horizontal axis machines.

[0014] Tub 64 includes a bottom wall 66 and a sidewall 68, and a basket 70 is rotatably mounted within wash tub 64. A pump assembly 72 is located beneath tub 64 and basket 70 for gravity assisted flow when draining tub 64. Pump assembly 72 includes a pump 74 and a motor 76. A pump inlet hose 80 extends from a wash tub outlet 82 in tub bottom wall 66 to a pump inlet 84, and a pump outlet hose 86 extends from a pump outlet 88 to an appliance washing machine water outlet 90 and ultimately to a building plumbing system discharge line (not shown) in flow communication with outlet 90.

[0015] Figure 2 is a front elevational schematic view of washing machine 50 including wash basket 70 rotatably mounted in wash tub 64 in a spaced apart relationship from tub side wall 64 and tub bottom 66. Accordingly, wash basket 70 and wash tub 64 define an annular space 92 that separates wash basket 70 and wash tub 64. Basket 70 includes a plurality of perforations therein to facilitate fluid communication between an interior of basket 70 and wash tub 64.

[0016] A hot water valve 102 and a cold water valve 104 deliver fluid to basket 70 and wash tub 64 through a respective hot liquid hose 106 and a cold liquid hose 108. Liquid valves 102, 104 and liquid hoses 106, 108 together form a liquid supply connection for washing machine 50 and, when connected to a building plumbing system (not shown), provide a water supply for use in washing machine 50. Liquid valves 102, 104 and liquid hoses 106, 108 are connected to a basket inlet tube

110, and fluid is dispersed from inlet tube 110 through a known nozzle assembly 112 having a number of openings therein to direct washing liquid into basket 70 at a given trajectory and velocity.

[0017] In an alternative embodiment, a known spray fill conduit 114 (shown in phantom in Figure 2) may be employed in lieu of nozzle assembly 112. Along the length of the spray fill conduit 114 are a plurality of openings arranged in a predetermined pattern to direct incoming streams of water in a downward tangential manner towards articles in basket 70. The openings in spray fill conduit 114 are located a predetermined distance apart from one another to produce an overlapping coverage of liquid streams into basket 70. Articles in basket 70 may therefore be uniformly wetted even when basket 70 is maintained in a stationary position.

[0018] A known agitation element 116, such as a vane agitator, impeller, auger, or oscillatory basket mechanism, or some combination thereof is disposed in basket 70 to impart an oscillatory motion to articles and liquid in basket 70. Basket 70 and agitator 116 are driven by motor 120.

[0019] Washing machine 50 also includes a brake assembly (not shown) selectively applied or released for respectively maintaining basket 70 in a stationary position within tub 64 or for allowing basket 70 to spin within tub 64. Pump assembly 72 is selectively activated, in the example embodiment, to remove liquid from basket 70 and tub 64 through drain outlet 90 and a drain valve 122 during appropriate points in washing cycles as machine 50 is used. In an exemplary embodiment, machine 50 also includes a chamber 124, a tube 126 and a pressure sensor 128. As fluid levels rise in wash tub 64, air is trapped in chamber 124 creating a pressure in tube 126 that pressure sensor 128 monitors. Liquid levels, and more specifically, changes in liquid levels in wash tub 64 may therefore be sensed, for example, to indicate laundry loads and to facilitate associated control decisions such as the control of hot and cold water valves 102 and 104 during fill operations. In further and alternative embodiments, load size and cycle effectiveness may be determined or evaluated using other known indicia, such as motor spin, torque, load weight, motor current, and voltage or current phase shifts.

[0020] A reservoir 130 is provided for dispensing wash additives such as bleach or conditioners and the like is provided to produce a wash solution by mixing fresh water with the additive thereby diluting the additive prior to introducing the additive into the wash liquid to assist in the cleansing of articles in basket 70. A

conduit 132 coupled to reservoir 130 delivers the diluted additive to annular space 92 between tub 64 and basket 70. In one embodiment, delivery of the diluted additive is accomplished by a siphon action and conduit 132 is a siphon tube coupled to reservoir 130. In an alternative embodiment, reservoir 130 includes a removable cover (see Figure 3) coupled to top cover 54 and conduit 132 is a siphon tube coupled to the removable reservoir cover.

[0021] Figure 3 is a perspective view of a portion of top cover 54 that lies beneath lid 62. Reservoir 130 is removably attached to top cover 54 and is shown separated from top cover 54 in Figure 3. Top cover 54 includes an opening 134 that is in flow communication with reservoir 130 when reservoir 130 is attached to top cover 54. In one embodiment, reservoir 130 includes a removable reservoir cover 131 that is removably attached, such as by snap fit engagement, to an upper side of top cover 54. Reservoir cover 131 includes an upper siphon fitting 133 that extends downwardly from reservoir cover 131. Reservoir 130 includes a lower siphon fitting 135 and an overflow port 136 that, should reservoir 130 become overfilled, empties excess additive into annular space 92 between tub 64 and basket 70. Wash additives are introduced into reservoir 130 through top cover opening 134 and an opening 137 in reservoir cover 131 that is in flow communication with opening 134 in top cover 54.

[0022] Being separable from top cover 54, reservoir 130 may be fabricated from the same or a different material than that of top cover 54. In addition, reservoir 130 may be fabricated in different sizes or volumes to accommodate a variety of dispenser additives. Further, reservoir 130 can be customized to fit the needs of particular customers or users. Reservoir 130 is attached to top cover 54 according to known methods and is also easily changed by a service technician.

[0023] Operation of machine 50 is controlled by a controller 138 which is operatively coupled to the user interface input located on washing machine backsplash 56 (shown in Figure 1) for user manipulation to select washing machine cycles and features. In response to user manipulation of the user interface input, controller 138 operates the various components of machine 50 to execute selected machine cycles and features.

[0024] Figure 4 is a schematic block diagram of an exemplary washing machine control system 150 for use with washing machine 50 (shown in Figures 1 and 2). Control system 150 includes controller 138 which may, for

example, be a microcomputer 140 coupled to a user interface input 141. As used herein, the term controller is not limited to just those integrated circuits referred to in the art as controllers, but broadly refers to microprocessors, computers, processors, microcontrollers, microcomputers, programmable logic controllers, application specific integrated circuits, field programmable gate arrays, and other programmable circuits, and these terms are used interchangeably herein. An operator may enter instructions or select desired washing machine cycles and features via user interface input 141, such as through input selectors 60 (shown in Figure 1) and a display or indicator 61 coupled to microcomputer 140 displays appropriate messages and/or indicators, such as a timer, and other known items of interest to washer users. A memory 142 is also coupled to microcomputer 140 and stores instructions, calibration constants, and other information as required to satisfactorily complete a selected wash cycle. Memory 142 may, for example, be a random access memory (RAM). In alternative embodiments, other forms of memory could be used in conjunction with RAM memory, including but not limited to flash memory (FLASH), programmable read only memory (PROM), and electronically erasable programmable read only memory (EEPROM).

[0025] Power to control system 150 is supplied to controller 138 by a power supply 146. Controller 138 is operatively coupled to machine drive system 148 (e.g., motor 120 and agitation element 116 shown in Figure 2), a brake assembly 151 associated with basket 70 (shown in Figure 2), machine water valves 152 (e.g., valves 102, 104 shown in Figure 2) and machine drain system 154 (e.g., drain pump assembly 72 and/or drain valve 122 shown in Figure 2) according to known methods. In a further embodiment, water valves 152 are in flow communication with a dispenser 153 (e.g., dispenser reservoir 130 shown in Figures 2 and 3) so that water may be mixed with an additive of benefit to washing of articles in wash basket 70.

[0026] In response to manipulation of user interface input 141, controller 138 monitors various operational factors of washing machine 50 with one or more sensors or transducers 156, and controller 138 executes operator selected functions and features according to known methods. Of course, controller 138 may be used to control washing machine system elements and to execute functions beyond those specifically described herein.

[0027] To facilitate ease of use of wash additives, the additive can be introduced into reservoir 130 at the beginning of a wash cycle and the dispensing of

the additive controlled automatically. Controller 138 implements the herein described methods.

[0028] The washing machine 50 is controlled to allow the user to pre-add a wash additive such as bleach to the reservoir 130 at or before starting the wash cycle. The additive is dispensed at a predetermined dispense time during the wash cycle. In the process flow to be described, the additive will be dispensed when about 2/3 of the wash cycle is complete. It is to be understood, however, that an optimal dispense time can be defined for different wash additives and the method adjusted accordingly. When the dispense time is reached, controller 138 activates water valves 152 to introduce water into reservoir 130, diluting the additive and raising the fluid level of diluted additive in reservoir 130 to a point where a siphoning action of the diluted additive begins. Conduit 132 delivers the diluted additive to annular space 92 between tub 64 and basket 70 so that the additive is not applied directly on the articles being washed. Basket 70 is held stationary during dispensing of the additive to facilitate avoiding splashing of the additive. The duration of the additive dispensing portion of the wash cycle is sufficient to fill and completely flush an empty reservoir 130 even at low inlet water pressures. In installations where the water flow rates are sufficiently high to overfill reservoir 130, the excess flow is allowed to escape reservoir 130 through overflow port 136. Overflow is also delivered to annular space 92 between tub 64 and basket 70. Reservoir 130 is filled and flushed in every wash cycle, regardless of whether or not the consumer uses a wash additive.

[0029] Figure 5 is a process flow diagram illustrating one method 200 for controlling the dispensing of a wash additive. Method 200 is executed in controller 138. Method 200 begins at step 210 where a determination is made if a pre-programmed wash cycle has been selected or if the user has manually set a wash time. If a pre-programmed cycle is selected, the total wash cycle time for the selected cycle is retrieved from a look-up table in memory 142 at step 212. If a pre-programmed cycle was not selected, processing continues at step 214 where the total wash cycle time is set as the user specified wash time. At step 216, the total wash cycle time, from either step 212 or 214 is saved in memory 142.

[0030] Processing continues at step 220 where a dispense time is determined based on the total wash cycle time. In one embodiment, the dispense time is set at 2/3 of the total wash cycle time when the additive is bleach. At step 222, the

dispense time as determined at step 220 is saved in memory 142. Controller 138 then monitors the time elapsed in the wash cycle as indicated at step 230. At step 240, controller 138 compares the wash cycle time elapsed to the dispense time saved in memory 142. If the dispense time has been reached, the method continues at step 242 wherein controller 138 activates water valves 152 to fill and flush reservoir 130, dispensing a wash additive, if present. As indicated at step 244, a pre-programmed time period is established for flushing reservoir 130. After the flush time period has elapsed, valves 152 are closed at step 246 and method 200 ends.

[0031] Method 200 is structured so that the user may change the wash cycle, and if changed, the additive dispense time is adjusted to facilitate dispensing of the additive at the proper time. If at step 240, the dispense time has not been reached, processing continues at step 250 where a check is made to determine whether the user has made any adjustment to the wash time. If no adjustments have been made, method 200 returns to step 230 and processing continues. On the other hand, if at step 250, it is determined that a change in the wash cycle has been made, processing continues at step 252 where a revised total wash cycle time is determined and saved in memory 152, replacing/updating the original total wash cycle time. Execution of method 200 is then transferred back to step 220 wherein a new dispense time is established based on the updated total wash cycle time. Method 200 continues from step 220 as previously described until the additive dispense time is reached unless the additive dispense time has already elapsed, in which case, the method skips to step 242 and the additive is immediately dispensed.

[0032] Method 200 is executed at every wash cycle, regardless of whether or not a wash additive is used. This approach facilitates keeping the dispenser reservoir 130 and conduit 132 clean and free from clogs and obstructions.

[0033] The above described apparatus and method provides an additive dispensing system for a washing machine that is both convenient for the consumer to use and economical to manufacture. The method allows the user to introduce the additive into the reservoir at the beginning of a wash cycle and does not require the user to revisit the washing machine to dispense the additive. The additive is dispensed at the proper time based on the total time of the wash cycle. The dispenser reservoir, being separable from the washing machine top cover, provides a product that can be customized for a particular use and that is readily serviceable.

From a manufacturing perspective, the separate dispenser reservoir allows multiple reservoir designs to used with a standardized top cover.

[0034] While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.